SMART ENERGY DECISIONS INNOVATION SUMMIT

LOCKHEED MARTIN OF 2025 Future of Energy Management

Devan Tracy Smart Buildings/Energy Analytics Lead March 12th, 2019 Houston, TX

JEVONS' PARADOX

If our machines use less energy, will we just use them more?

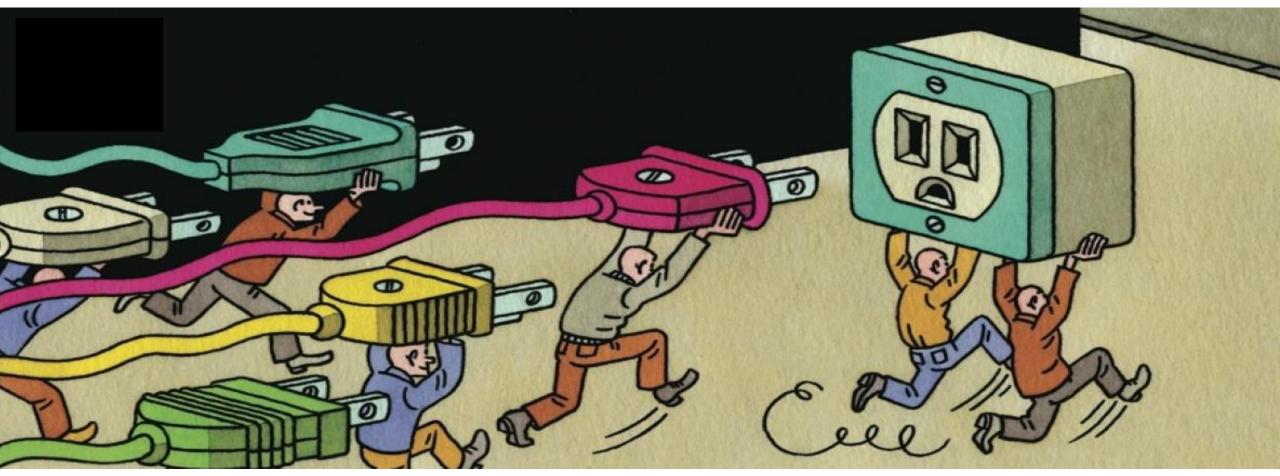
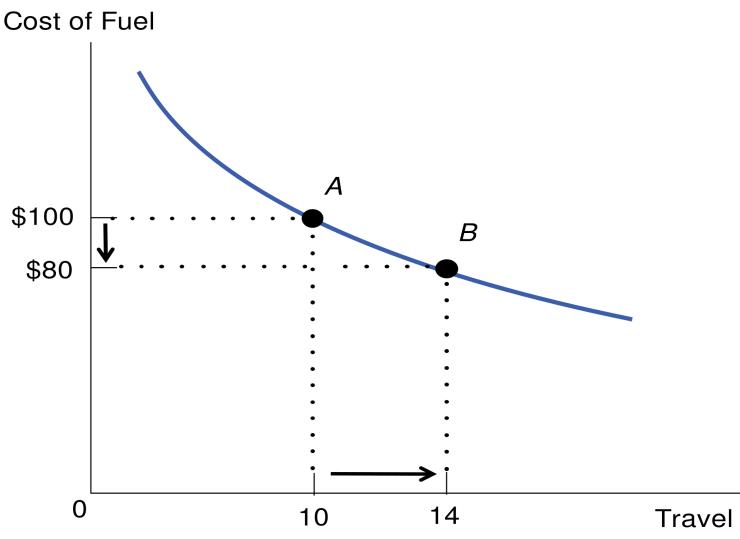


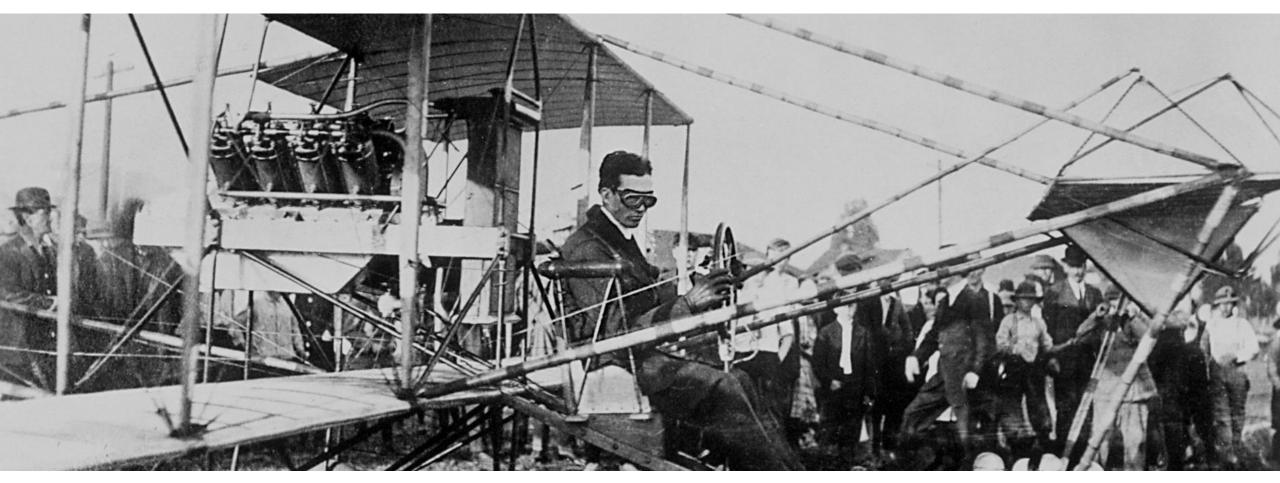
Illustration by JOOST SWARTE, The New Yorker, Dec '10

THE REBOUND EFFECT

Efficiency vs. Demand



SUSTAINABILITY: IT IS IN OUR DNA



Our founders worked complex questions of fuel efficiency, flight sustainability, and civic consciousness into their early product designs and business plans.



"[The US Navy is] an infinitely more potent factor for peace than all the peace societies of every kind and sort"

President Theodore Roosevelt







PRESENT

LOCKHEED MARTIN'S STRATEGIC SUSTAINABILITY PRIORITIES

🖗 BUSINESS INTEGRITY

Advancing standards and controls for ethical business conduct that strengthen customer relationships, supplier partnerships and workplace integrity.



Delivering optimal life-cycle value by engineering innovative solutions for resilient energy, global security, telecommunications and other critical infrastructure.



Creating a high-performance, inclusive workplace culture that engages employees and creates rewarding career paths for our current and future workforce.

RESOURCE EFFICIENCY

Increasing business resiliency and accelerating carbon reduction through improved energy and water management, materials conservation and increased renewable energy use.

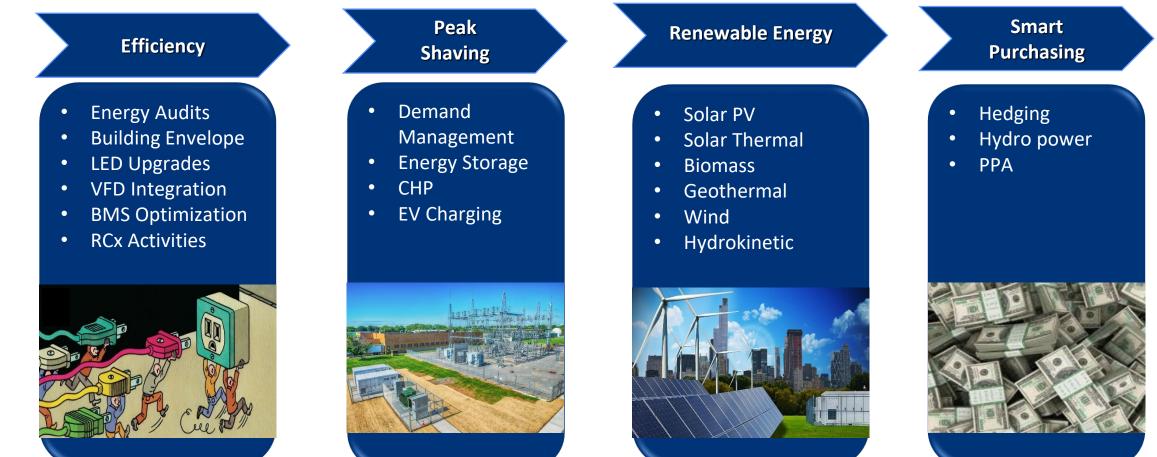
\Im information security

Minimizing likelihood and impact of our security incidents on our business operations and customer missions and protecting business-sensitive, customer and personal information from external and internal threats.





ENERGY STRATEGY



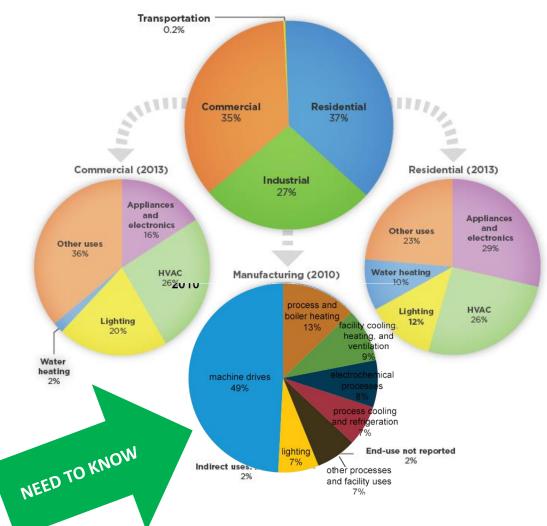
Data Analytics: Industrial Internet of Things (Sensors, AI, Machine Learning, Root Cause Analysis, Fault Detection)

People



IDEAL STATE HEATMAP

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
HVAC										
VFDs on all motors										
Pumps										
Cooling Tower Fan										
Condensor Water Pump										
Trim Chiller										
AHUs										
Chilled Water Distribution										
Convert constant volume to variable on demand										
CO2 demand										
Free cooling										
Air-side economizers										
Right-sized equipment										
Temperature setpoints meet requirements										
Building envelope										
Elemeinate all balancing bypasses on chilled water distribution										
Eliminate decoupler on preimary pumps										
Convert 3-way control valves to 2-way on chilled water distribution										
Natural Gas Consumpion										
Minimize steam										
Steam trap program										
Point of use (e.g., infrared, air rotation)										
Boiler efficiency of >83%										
Heat recovery										
Alternate to back-up boiler										
Understand natural gas usage metrics (MCF/HDD)										
Electric Distribution										
All primary breakers metered										
All substation breakers metered										



Source: U.S. Energy Information Administration

10

FUTURE

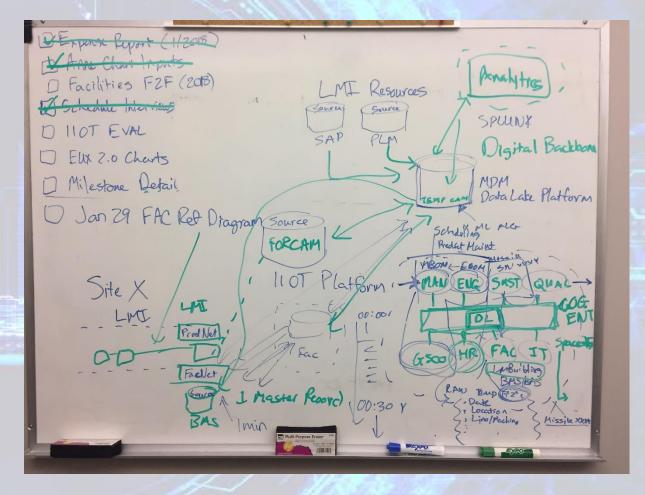
WHAT IS A "SMART BUILDING" OF THE FUTURE?





VISION MAPPING



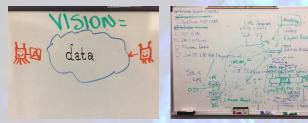


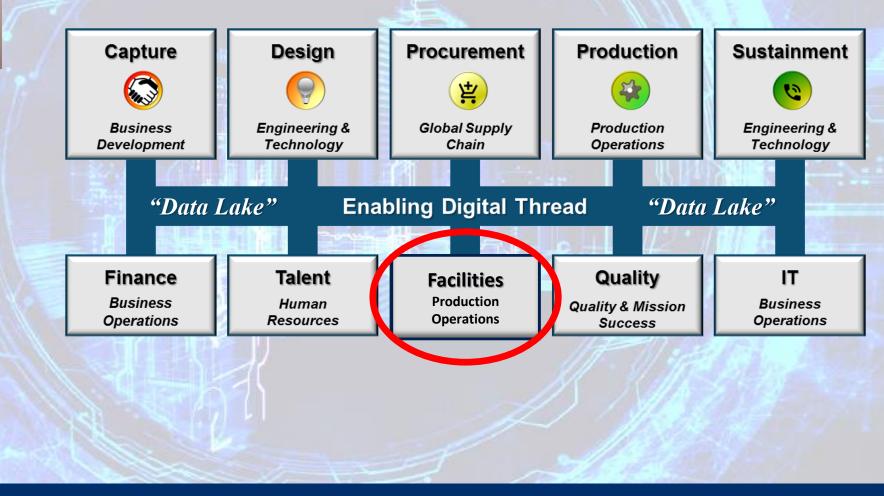
Facilities / ESH Manager

IT Manager



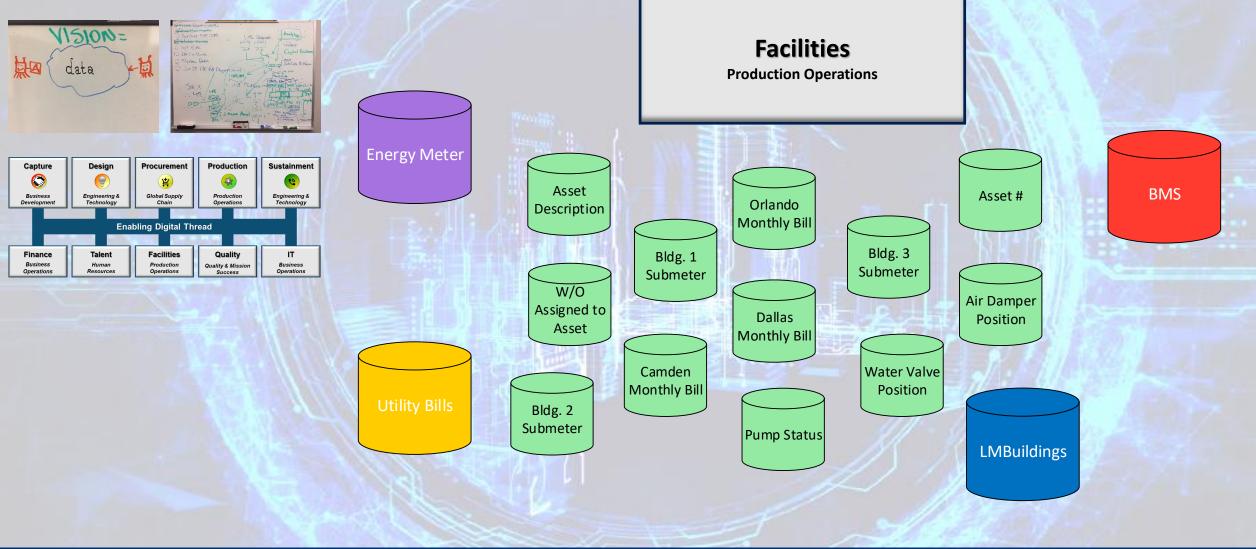
VISION MAPPING



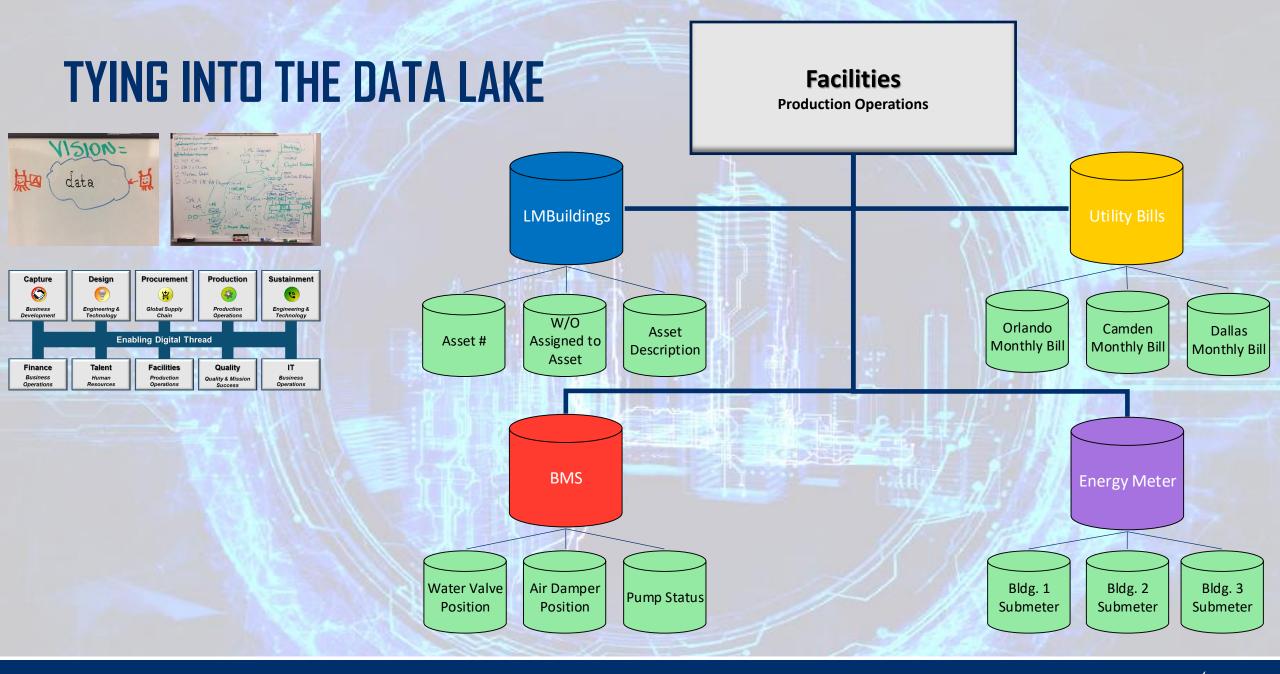




FACILITIES DATA & SYSTEMS



LOCKHEED MARTIN 15



LOCKHEED MARTIN 16

EXAMPLE USE CASES

Predictive Maintenance

When do we need to replace the filter?

What is the probability the boiler will fail?

Is the generator running normally?

Monitoring

How many technicians are in the room?

Is my system experiencing instability?

Is there a door/ window open?

Forecasting

How much energy will What will the building we use this week? temperature be at 3pm?

Do we need to turn on extra boilers to meet demand today?

Simulation/Optimization

What if we moved high energy tasks to non peak times? How likely are we to reach desired building temperature with this operating plan?



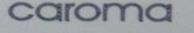
MOVE FROM REACTIVE TO ADAPTIVE



CULTURE SHIFTS

ADOPTING NEW TECH WITHOUT ACCOUNTING FOR HUMAN IMPLICATIONS IS AN INCOMPLETE APPROACH

OBJECTIVE: Give the user control and opportunity to learn



alowa



IF YOU THINK ADVENTURE IS DANGEROUS... TRY ROUTINE, IT'S LETHAL. -COELHO



